



Case report

Sudden death during medical thoracoscopy



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ABSTRACT

Medical thoracoscopy (or pleuroscopy) is a valuable diagnostic tool in patients with pleural pathology, being minimally invasive, inexpensive and relatively easy to learn. Complications may occur, depending on the complexity of the case, and mainly include broncho-pleural fistulas, chest infections, arrhythmia, severe hemorrhage due to blood vessel injury, and air or gas embolism. Death is very rare.

The present report describes the peculiar case of a 72-year-old woman affected by a pleural empyema who suddenly and unexpectedly died during medical thoracoscopy.

On autopsy, three small perforations of the right lung were found, without involvement of major vessels or bronchial ramifications.

After a brief overview of medical thoracoscopy and its complications, the fatality and its possible pathophysiological mechanisms are analyzed through a review of the literature.

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1. Introduction

Performed for the first time by Sir Francis Richard Cruise in 1866 on an 11-year-old girl with a history of cough and pain in the left side of the chest¹ and introduced into the treatment of tuberculosis by Jacobaeus in 1910,² thoracoscopy is a method whereby an optical system is used to examine the pleural cavity, to perform biopsies of visceral and parietal pleural surfaces of the lung parenchyma and to carry out other minimally invasive procedures within the chest cavity.

Medical thoracoscopy is now less frequently undertaken to treat tuberculosis because of the reduced incidence of this disease in Western countries. However, it has become the gold standard in the diagnosis and treatment of pleural pathologies, especially pleural effusions.³ Specifically, it is mainly used for diagnostic purposes, especially when other procedures have not been diagnostic, and as a therapeutic mean in talc pleurodesis ('poudrage') to prevent recurrence of persistent pleural effusions or pneumothorax.⁴ To

date, it is the gold standard in the diagnosis and management of malignancy.⁵

It is usually performed under local anesthesia and some conscious sedation. It is less invasive, less expensive and easier to learn than more invasive procedures which require general anesthesia.⁶

While it is considered a safe procedure and has a low complication rate in expert hands, sometimes complications may occur. These are mainly constituted by broncho-pleural fistulas, chest infections, arrhythmia, severe hemorrhage due to blood vessel injury, and air or gas embolism; death is very rare.⁷

We present the case of a 72-years-old woman who suddenly and unexpectedly died during the execution of a medical thoracoscopy performed because of pleural empyema, and discuss this fatality and its pathophysiological mechanisms through a review of the literature.

2. Case report

2.1. Case history

A non-smoking 72-year-old woman was referred to hospital because of right thoracic pain. Her medical history revealed only obesity and high blood pressure. Apart from anti-hypertensive therapy, she was not on any medication.

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She presented severe thoracic pain, dyspnea and fatigue. An ECG was performed, which did not reveal any pathological features, and also myocardial enzymes were negative. The following day, she developed a non-productive cough and fever (38 °C) and right-inferior hypophonesis was found. Arterial blood gas test resulted in pH 7.43, P_aCO_2 37.1 mm Hg, P_aO_2 68.6 mm Hg, Sat. O_2 93.9%. A chest radiograph revealed right pleural effusion, confirmed by computed tomography, and right thoracentesis showed the presence of muddy yellowish liquid (ph 6.73). An empyema was suspected.

In the light of this finding, physicians decided to perform a medical thoracoscopy. The patient was under cardiac and blood pressure monitoring through all the process.

According to the medical record, the procedure was performed by means of a rigid thoracoscope through a direct access on the posterior axillary line, after local anesthesia with 2% lidocaine (20 ml). The right pleural cavity was first explored with a thoracentesis needle, and several centiliters of purulent liquid were withdrawn; the skin was then incised and the trocar was inserted. The exploration was immediately interrupted because of the onset of coughing and hemoptysis. After a few minutes, the patient died of cardiac arrest (asystolia), despite 20 min of attempts at cardio-pulmonary resuscitation (both drugs and cardioversion).

As this death was totally unexpected, the coroner decided to carry out an autopsy, which was performed 48 h later.

2.2. Autopsy findings

External inspection of the corpse revealed a skin incision on the right side of the thorax immediately under the axilla and on the right axillary line. The incision had neat, infiltrated edges of nearly 2 cm in length and its longer axis was perpendicular to the body.

Before section, pneumothorax was investigated in both pleural spaces by inserting a wide-bore needle attached to a water-filled syringe into the subcutaneous tissue above an intercostal space and then into the pleural space and it was evident on the right side.

En-bloc removal of the thoracic pluck (i.e. neck structures, heart, lungs, and mediastinum) was performed in order to preserve inter-organ relationships and effects.

The trachea and larynx were partially replete with mucus mixed with blood. In the right pleural space, muddy yellowish liquid was found (800 cc). On the anterior-lateral surface of the inferior lobe of the right lung, three small lesions of the pleura and of the lung parenchyma were found (Fig. 1); these had neat, open margins. One

lesion was 15 mm in length and its lumen was occupied by a blood clot. The other two were 10 and 6 mm in length, more superficial and less infiltrated by blood. In addition, the surface of the right lung showed a thick white fibrous layer strongly adherent to the visceral pleura. The mainstem bronchi showed no signs of lesions, but their lumina were occupied by mucus mixed with blood. The right lung was sampled *in toto* and immersed in formalin. No signs of pulmonary embolism, neither gas nor blood clot in the pulmonary circulation were found.

The heart was of normal size and weight with abundant sub-epicardial fat. Both atria and ventricles were normal. The coronary vessels were sclerotic, but their lumina were not reduced. No pathological findings were observed in the other organs.

After fixation, the right lung was examined; the traumatic lesions were superficial, penetrating 2–3 mm into the parenchyma. The largest one was occupied by a thrombus, though no vessel had been injured. This lesion was surrounded by an area of hemorrhage of approximately 1.5 cm in diameter in the parenchyma. The principal bronchus was patent, while the inferior bronchus was obstructed by clotted blood mixed with purulent material.

Histological examination was performed on the samples collected during autopsy. The heart displayed diffuse sclerosis with undulation, fragmentation and dissociation of fibers; while the lungs showed microscopic signs of emphysema and distelektasia with focal areas of pneumonia in various stages of evolution, up to fibrosis and hemorrhage.

3. Discussion

Used for decades in Europe in the diagnosis and management of pleural processes, medical thoracoscopy, a term used in order to distinguish the old conventional thoracoscopy technique from 'video-assisted thoracoscopic surgery' (VATS), is generally considered a safe procedure.⁸

Table 1

Complications of medical thoracoscopy reported in the literature.

| Study | Number of cases | Complications | Incidence |
|---------------------------------|---|------------------------------|-----------|
| Viskum and Enk ¹⁹ | Revision of 2298 reported procedures in 15 series | Subcutaneous emphysema | 1.3% |
| | | Empyema | 2% |
| | | Significant bleeding | 2.3% |
| | | Air embolism | 0.2% |
| | | Death | 0.09% |
| Viallat et al. ²⁴ | 360 cases | Subcutaneous emphysema | 0.6% |
| | | Empyema | 2.5% |
| de Campos et al. ²⁵ | 614 cases | Empyema | 2.7% |
| | | Re-expansion pulmonary edema | 2.2% |
| | | Respiratory failure | 1.3% |
| | | Air leakage | 0.5% |
| | | Postoperative bleeding | 0.4% |
| Rodriguez-Panadero ⁶ | 411 cases | Air leakage | 9% |
| | | Subcutaneous emphysema | 4.9% |
| | | Empyema | 1.9% |
| | | Postoperative bleeding | 0.7% |
| | | Pulmonary embolism | 2.7% |
| Boutin ²⁶ | 188 cases | Death | 0.2% |
| | | Subcutaneous emphysema | 0.5% |
| Harris ⁷ | 182 cases | Empyema | 2.1% |
| | | Postoperative bleeding | 1.6% |
| | | Air leakage | 3% |
| | | Subcutaneous emphysema | 4% |
| | | Empyema | 2% |
| Blanc ²⁷ | 168 cases | Postoperative bleeding | 4% |
| | | Death | 0.5% |
| | | Subcutaneous emphysema | 5.3% |
| | | Empyema | 3.6% |
| | | Pulmonary embolism | 0.6% |
| | | Death | 0.6% |

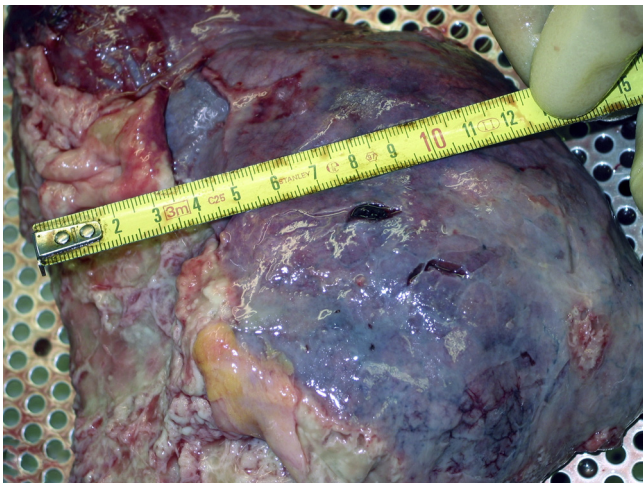


Fig. 1. Small perforation on the surface of the right lung.

Potential adverse events include bleeding, persistent pneumothorax, intercostal nerve and vessel injury, cardiac disturbances, complications related to anesthesia, respiratory failure, wound infections, and malignant seeding of the chest wall (Table 1 summarizes the risks of thoracoscopy). The risks partly depend on the relative invasiveness of the procedure. For example, the risk of bleeding increases when pleural biopsies are taken.^{9,10,11}

Overall complication rates for thoracoscopy range from 1% to 5%. However, most complications are minor and do not prolong hospitalization.¹⁴ Complications include subcutaneous emphysema (0.6%–5%), infection empyema (2%–3%), significant bleeding (0.4%–2%), pulmonary embolism (0.6–4%) and re-expansion pulmonary edema (2.2%). Procedure-related death is quite rare, ranging between 0% and 0.6%.^{12–16}

Technically, medical thoracoscopy is usually performed in a sedated but spontaneously breathing, non-intubated patient with basic monitoring.¹⁷

Rigid endoscopic equipment requires a cold light source, an endoscopic camera, a video monitor and a recorder. The trocars used come in different sizes and materials.

Medical thoracoscopy is performed by means of a single- or double-puncture technique, the former being used for diagnostic pleuroscopy and talc poudrage, while the latter is used to facilitate adhesiolysis, the drainage of complex loculated fluid collections and lung biopsy.

An injection of local anesthetic is usually sufficient to achieve a good anesthesia of the intercostal space tissues and the thoracic pleura, which is essential.⁴

After the trocar has been inserted, the pleural cavity is exposed to atmospheric pressure. The lung then collapses because of unopposed elastic recoil, resulting in paradoxical respiration and mediastinal shift. Hence, gas exchange may be impaired so it is important to administer supplementary oxygen and to perform rapidly the procedure.¹⁷

In the case presented, thoracoscopy was performed by means of a rigid instrument and a single puncture under local anesthesia. As described above, as soon as the trocar was introduced, coughing and hemoptysis ensued and the patient suddenly died of cardiac arrest.

Autopsy data indicate that the pressure exerted on the lung by the instrument was the most likely cause of cough, while the three small lesions on the lung parenchyma were probably the source of the hemoptysis. The three small right lung perforations did not involve major vessels or bronchial ramifications so it is unlikely that the small hemorrhage in the airways could have caused a fatal hypovolemic shock or a bronchial inundation. In other words, the lesions of the lung parenchyma, though iatrogenic in nature, cannot be regarded as the only cause of death. In light of the data collected and the manner of this patient's death, a complex and faster mechanism should be suspected.

Some reports in literature indicate that local anesthetic infiltration may not block afferents in the phrenic, vagus or recurrent laryngeal nerves, thereby eliciting the possible onset of pain and vagal reflexes, especially in obese patients¹⁸. The vagus nerve vehicles most of the peripheral nervous system (PNS) innervating the heart, lungs, esophagus, stomach, small intestine, proximal half of the colon, liver, gallbladder, pancreas, and upper portions of the ureters.

The PNS fibers are distributed mainly to the sinoatrial and atrioventricular nodes and to a lesser extent to the atria. Little or no distribution to the ventricles can be found. Therefore, the main effect of vagal cardiac stimulation is chronotropic, decreasing the rate of sinoatrial node discharge and the excitability of the AV junctional fibers, slowing impulse conduction to the ventricles. A

strong vagal discharge can totally arrest sinoatrial node firing, blocking impulse conduction to the ventricles.¹⁹

It has been shown in rabbits that increased pressure on the thoracic pleura reduces both the amplitude of phrenic nerve discharge and systolic and diastolic pressure, with no correlation being seen between stimulus duration and the magnitude of the blood pressure response.²⁰

Moreover, it has been reported in literature that increased parasympathetic activation can cause cardiac arrest^{21,22} and that vagal denervation can improve the symptoms of neutrally mediated syncope.²³

In this case probably a range of reflexes developed when the optic was inserted into the chest cavity. Marked parasympathetic activation due to inefficient anesthetization of the thoracic wall might have exerted a strong inhibitory effect on the heart.

Hence, from a pathophysiological point of view, a combined fatal mechanism may be suspected. The patient was already in respiratory distress, partly because of her obesity and partly because of the considerable pleural effusion. Manipulation of the lung resulted in a cough reflex, making it difficult for the operator to avoid causing the iatrogenic lesions on the lung surface. The resulting hemorrhage obstructed a portion of the smaller airways and triggered an asphyxial mechanism. At the same time, the persisting stimulation of the thoracic pleura by the trocar elicited a reflex inhibition of the heart, with consequent cardiac arrest.

The case presented has several implications for clinicians, researchers and forensic scientists. From a clinical point of view, it has to be stressed that, although medical thoracoscopy is widely used and relatively safe, it is still an invasive procedure which can endanger the patient's life. In particular, it should be remembered that the anesthesia technique must always be carefully planned before the procedure and that the mode of administration and the precautions to be taken must be assessed, in order to prevent neural reflexes which might cause discomfort or jeopardize the patient's safety. In this regard, research should aim at ascertaining the possible reflexes which stimulation of the pleura may elicit and how they can be prevented or lessened.

Finally, from a medico-legal point of view, whenever investigating a case of possible medical liability, experts should thoroughly evaluate the clinical history of the patient and carefully review the scientific literature, in order to better identify all possible mechanisms of death and the risk of medical malpractice.

Recent decades have witnessed a dramatic increase in medical litigation. Although medical thoracoscopy is a safe procedure, it is essential that the operator be aware of the risks involved. In this regard, training and updating could be an effective means of achieving adequate prevention of the risk of litigation.

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Conflict of interest

There is no conflict of interest.

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